(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
23 August 2001 (23.08.2001)

PCT

(10) International Publication Number
WO 01/61892 A2

(51) International Patent Classification[7]: H04H

(21) International Application Number: PCT/US01/05104

(22) International Filing Date: 16 February 2001 (16.02.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/507,255 18 February 2000 (18.02.2000) US

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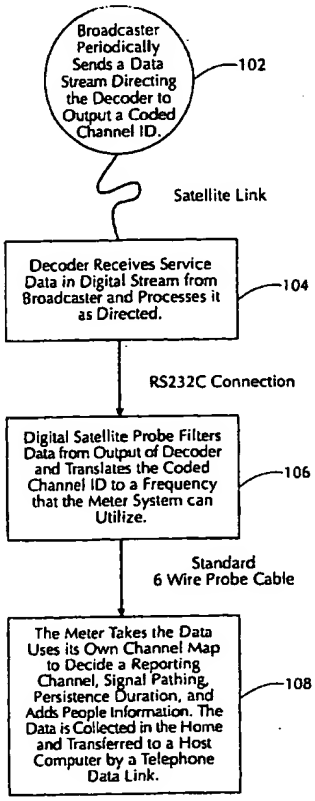
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,

[Continued on next page]

(54) Title: AUDIENCE MEASUREMENT SYSTEM AND METHOD FOR DIGITAL BROADCASTS



(57) Abstract: A method is disclosed wherein audience measurement data for digital broadcasts, both program lineup verification and statistical audience samples, are collected from data added by the broadcaster for this purpose. A coded channel ID and other program identification data is placed in the service ID stream and the decoder or receiving device is directed to output this data to the device's communication port. A probe attached to the communication port is disclosed whereby this data is extracted and decoded for use by a data collection system in statistically selected homes for accurate audience measurement of digital programming.

WO 01/61892 A2

IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

AUDIENCE MEASUREMENT SYSTEM AND METHOD FOR DIGITAL BROADCASTS

BACKGROUND OF THE INVENTION

1. Technical Field

The present invention relates to program identification and audience measurement, and more specifically, to identification of digital broadcasts of television and radio programs.

2. Description of the Prior Art

Systems for the quantification of audiences of analog television and radio broadcasts, including the identification of channels and programs being received, are well known. However, with the increase in digital broadcasts in addition to or replacement of analog broadcasts, the known systems either fail to function or function inefficiently.

A typical audience measurement system determines both the channels to which the receivers in the statistically selected households are tuned and the times that the receivers are tuned to those channels. The tuned channels, and the times during which those channels are tuned, are periodically transmitted to a central facility where the tuned channels, and the times during which those channels are tuned, are compared to a program record which is compiled from information supplied by the sources of programs, and is intended to reflect the identity of the programs which are supposed to be aired at the times indicated in the program record. Systems which read codes imbedded in the program material by broadcasters or syndicators are used to verify the accuracy of the program records, i.e. that the programs were actually aired at the intended times as indicated in the program records.

An example of such a system is disclosed in U.S. Pat. No. 4,025,851. The system disclosed therein monitors those programs which have codes written on video lines of one or more of the video programs' vertical blanking intervals. The system described in this patent, referred to therein as the Automated Monitoring of Line-up (AMOL) system, has been in

general use in the United States for over a decade, and is used to determine (i) the identities of aired programs, (ii) the local stations which air these programs, and (iii) the times during which these programs are aired. A system of this type significantly reduces the complexity, and improves the accuracy, of the resulting program records that are an essential element of current television audience measurements. The AMOL system is not used within a sample household due to code loss problems that can be more successfully remedied at a broadcast monitoring site, but that may be intractable in the sample household.

A system for radio audience monitoring is disclosed by Weinblatt in U.S. Pat. No. 4,718,106. Weinblatt teaches an audience measurement system in which each participant wears a metering device that includes a microphone and a detection circuit which responds to in-band codes in the programming. Weinblatt discusses background noise as a problem in this method, and teaches that such noise is avoidable by using a microphone having a low sensitivity. The system disclosed in U.S. Pat. No. 4,807,031 utilizes a robust video luminance coding method with a low data rate. The system disclosed in U.S. Pat. No. 4,945,412 utilizes a subaudible 40 Hz tone to encode the audio portion of a broadcast.

The foregoing systems, which rely upon encoded broadcasts, require that all programs be encoded by at least one of the sources (e.g., broadcasters) in the distribution system. Even in the unlikely event that all broadcasters were to agree to cooperate, occasional encoding equipment failures would likely cause gaps in the data provided by systems that rely solely on codes. These gaps would cause losses of rating data and would render all of the audience share measurements meaningless whenever any significant number of programs were not encoded. Thus, there is a need to collect program identifying data even when there is no code present in the programs to be identified.

Several broadcast measurement systems have been suggested which do not detect embedded codes in order to identify programs, but which instead monitor program content.

These systems generally receive programs to be monitored at a measurement site (e.g. sample household), extract broadcast signatures from the programs, and compare these broadcast signatures with corresponding reference signatures extracted from reference copies of these programs (e.g., distribution tapes) or from previous broadcasts of the programs being monitored. For example, in U.S. Pat. No. 4,697,209, a program monitoring system is disclosed in which broadcast signatures are collected in sampled households relative to certain program content (e.g., a scene change in the video portion of a monitored program). These broadcast signatures are subsequently compared to reference signatures collected by reference equipment tuned to broadcast sources available in the selected market. A coincidence between the broadcast signature and the corresponding reference signature identifies the programs, not just the channel, being viewed.

A program monitoring system disclosed in U.S. Pat. No. 4,677,466, logs the broadcasts of selected programs (e.g., commercial advertisements). This monitoring system makes video tape recordings of unrecognized, suspected commercials (e.g., programs existing for short intervals which typically begin and end with a blank frame interval and which have lengths generally commensurate with the typical lengths of commercials) for subsequent viewing so that manual identification of the unrecognized, suspected commercials may be made by a human operator. In order to manually identify those unrecognized, suspected commercials on the video tape recordings, such recordings must be transmitted to the human operator. As the unrecognized, suspected commercials are manually identified, they are given program ID's as appropriate.

Systems which rely upon the extraction of signatures in order to identify programs, however, also have well-known shortcomings. Such systems are computationally expensive, and their use has been restricted by the cost of computer hardware. Additionally, such systems rely on reference measurement sites that collect reference signatures from known

program sources. When one set of reference equipment fails, all reference signature data for those program sources may be lost. If the lost data accounts for a significant fraction of tuning activity, the widely used statistic normally referred to as "share" becomes correspondingly unreliable. It might be noted in the interest of fairness that a functioning backup site can prevent the loss of this data.

Another known method is to transmit (e.g., over a telephone connection) digitally compressed video and/or audio replicas of programs. For example, in U.S. Pat. No. 4,888,638, programs are compressed and are sent over telephone lines to households. The compressed programs are stored in equipment in the households, and are subsequently displayed on television receivers as substitutes for regularly scheduled programs when certain preselected conditions are met (such as in response to program ID's contained in the compressed programs). A more recent teaching relating to the use of compressed video and/or audio replicas is disclosed by Strubbe in U.S. Pat. No. 5,223,924. Strubbe's system permits a television viewer to select programs for future viewing or recording based on the viewer's exposure to facsimiles of the program material generated from the compressed replicas stored in a database in the viewer's home.

U.S. Pat. No. 4,547,804 disclosed a method and apparatus for the automatic identification and verification of commercial broadcast programs. A digital encoded identifying number is embedded in the programs, by which they can be automatically monitored, to verify that they have been broadcast as and when intended. However, the digital number is embedded in what is otherwise an analog program. This method is usable only during the transition period from analog to digital broadcasting technology, when some digital equipment or connection is in use together with older analog equipment or connections. It will not work when the broadcasting stations have fully digital operations, e.g., recording a program in digital form, storing it digitally on tape or disk, performing

nonlinear digital edits and digital commercial insertions, and transmitting digitally over the air, or delivering a digital stream to a cable or satellite operator to multiplex with other digital streams.

In U.S. Patent No. 3,919,479 a process is disclosed for automatic electronic recognition and identification of programs and commercial advertisements broadcast on television and radio wherein a digitally sampled reference signal segment derived from either the audio or the video portion of the original program content to be identified is compared with successive digitally sampled segments of the corresponding audio or video portion of a broadcast signal in a correlation process to produce a correlation function signal. The sampling rates and the time duration of the reference signal segment and the broadcast signal segments are the same. When the signal segments that are compared are the same, the correlation function signal is relatively large and a recognition of the broadcast signal is achieved when such correlation function signal exceeds a selected threshold level. The compared signal segments may also be obtained as low frequency signals derived from the original reference and broadcast signals by non-linear and envelope formation processing techniques.

U.S. Pat. No. 4,647,974 discloses a system for the automatic insertion of auxiliary video information into an analog television signal. The system may be used by a local station to insert its call letters or logo into network programming.

U.S. Pat. No. 4,697,209 discloses a method and apparatus for identifying television programs, by detecting the occurrence of events such as scene changes in a video signal, and extracting a signature from the signal. Signatures and their times of occurrence are stored and compared with reference signatures to identify the program. As the system is independent of the format used to transmit the signal, it will work with both analog and digital television. It has the disadvantage of requiring that a large volume of reference data

be collected for every possible station transmitting and program being transmitted, and for every site monitored, which will require a large computing capacity and a long computing time to correlate the two sets of data to determine which station or program is being received at each monitored site at each instant that each receiver is turned on.

U.S. Patent No. 4,230,990 teaches an automated method and system for identifying broadcast programs wherein a pattern recognition process is combined with a signaling event which acts as a trigger signal. At least one such trigger, or "cue" signal, occurs with each broadcast of every program which is to be identified; and these signals are used to activate the pattern recognition process which results in program identification. These cue signals can either be artificially inserted into the program signal or they can be events that occur naturally as part of normal broadcast procedures. A segment of each program at a predetermined location with respect to one of these cue signals is sampled and processed according to a feature extraction algorithm to form the program's reference signature, which is stored in computer memory. In the field, the monitoring equipment detects cue signals broadcast by a monitored station and, upon detection, samples the broadcast program signal at the same predetermined location with respect to the detected cue and uses the same feature extraction process to create a broadcast signature of unknown program identity. By comparing broadcast signatures to reference signatures, a computer identifies the broadcasts of programs whose reference signatures have been stored in memory.

U.S. Pat. No. 4,972,503 discloses a method and apparatus for determining the channel to which a remotely controlled television receiver is tuned. While it is independent of the format (analog or digital) used to transmit the signal, its implementation on a mass scale for audience ratings will not be practical, as it requires an individual hardware or software adaptation to each remote control used in the monitored sites to determine what function is activated when a key pressing is detected.

U.S. Patent No. 4,425,578 teaches a system and method for determining the channel to which a video wave receiver is tuned. The system includes an RF signal source connected to the antenna input of the video wave receiver, a frequency control stage that determines the signal frequencies generated by the RF signal source and a system and advance control stage to appropriately program operation of the frequency control stage. The RF signal source is conditioned by the system and advance control stage and the frequency control stage to output signals such that the fundamental or one of the harmonics when combined with the video carrier of a corresponding channel results in a signal having a predetermined frequency. The RF signal source is successively advanced to output a set of predetermined frequencies, corresponding to each of the receivable channels to which the video receiver is tunable. The system includes a detector/receiver arranged to monitor the video signal of the video receiver to detect the predetermined frequency resulting from the combined signal from the RF signal source and a video carrier to which the video receiver is tuned. The RF signal source is stepped through a predetermined set of frequencies corresponding to each receivable channel and the system outputs a signal denoting the received channel to which the video receiver is tuned when the predetermined frequency is detected by the detector/receiver.

U.S. Pat. No. 5,019,899 discloses an electronic data encoding and recognition system for creating digital signatures from frames of selected video segments such as television commercials by a digitalizing, compression and selection process which produces a multi-digit signature from each frame.

U.S. Pat. No. 5,278,988 discloses a method and apparatus for determining the transmitting station from which analog program signals are received and translated by a monitored receiver within a test area.

U.S. Pat. No. 5,425,100 discloses a multilevel encoded signal monitoring system and a universal broadcast code for identifying programs, commercial, networks, stations, etc.

U.S. Patent No. 4,723,302 teaches a method and apparatus for identifying a channel to which a receiver is tuned by sequentially detecting a signal of the receiver and storing a characteristic value of the detected signal for a predefined sequence of frequencies. The stored values corresponding to the predetermined channels of the receiver are identified and assigned predetermined values. The stored values corresponding to each of a plurality of harmonic frequencies of the predetermined channels are identified and assigned one of a plurality of different predetermined values. A total assigned value is then calculated for each of the predetermined channels with the corresponding values for the identified harmonic frequencies thereof. The calculated total values are then compared to identify a maximum value corresponding to the channel to which the receiver is tuned.

U.S. Pat. No. 5,450,122 discloses an in-station method and apparatus for encoding analog television programs, including commercials, with a digital identification code recorded on a selected video scan line which is not normally visible to the television viewer, and for verifying the proper airing of such programs by television broadcast stations.

U.S. Pat. No. 5,450,490 discloses apparatus and methods for including an inaudible code in an analog audio signal, and for decoding it.

In U.S. Patent No. 4,739,398 a method, apparatus and system are provided for recognizing broadcast segments, such as commercials, in real time by continuous pattern recognition without resorting to cues or codes in the broadcast signal. Each broadcast frame is parametized to yield a digital word and a signature is constructed for segments to be recognized by selecting, in accordance with a set of predetermined rules, a number of words from among random locations throughout the segment and storing them along with offset information indicating their relative locations. As a broadcast signal is monitored, it is

parametized in the same way and the library of signatures is compared against each digital word and words offset therefrom by the stored offset amounts. A data reduction technique minimizes the number of comparisons required which still require maintaining a large database.

U.S. Pat. No. 5,512,933 discloses a system for identifying a program stream being displayed at a receiver location, by measuring the relative luminance of a plurality of predetermined areas in each frame of a television transmission, at both the transmitting station and the receiver. As the system is independent of the format used to transmit the signal, it will work for both analog and digital television. But it has the disadvantage of requiring that a large volume of reference data be collected for every possible station transmitting and program being transmitted, and for every site monitored, as well as requiring a large computing capacity and a long computing time to correlate the two sets of data to determine which station or program has been received at each monitored site at each instant that the receiver was turned on.

U.S. Pat. No. 5,574,962 discloses a method and apparatus for automatically identifying a program, by adding an inaudible encoded message to the audio signal.

U.S. Patent No. 5,243,423 discloses a co-channel communication system that allows transmission of one or more data signals in an active or visible portion of video raster in a manner that is imperceptible to a viewer. More particularly, the data signal is transmitted over preselected active video lines of a video raster. In order to reduce the perceptibility of the data signal, the video lines over which the data signal is transmitted are varied according to a random sequence. In an alternate embodiment, the data is also modulated at relatively low modulation levels, for example, by converting the data signal to a spread spectrum signal.

U.S. Pat. No. 5,646,675 discloses a system and method for monitoring the reception of video program material, using codes inserted on scan lines.

U.S. Patent No. 5,594,934 discloses a correlation meter for determining tuning status of a tunable receiver. The correlation meter receives an output of the tunable receiver, such as an acoustic audio output of the tunable receiver. An analog to digital converter converts the output of the tunable receiver to a digital sample side representation. An antenna or other signal collector receives reference side representations corresponding to channels to which the tunable receiver may be tuned. The correlation meter correlates the digital sample side representation and the reference side representations as the reference side representations are received by the correlation meter in order to determine the tuning status of the tunable receiver.

U.S. Patent No. 4,885,632 discloses a system and methods for monitoring a home TV viewing system which may include a TV, a VCR and one or more cable converters. The system obtains information for identifying the source of video displayed or being recorded, i.e., off-air antenna, satellite antenna, cable converter tuner, VCR, personal computer, video game, etc. The system also obtains information identifying the video path of the video being displayed and/or recorded. The system "fingerprints" video recorded by the VCR so that the played back video may be identified as having been previously recorded. The system may record the date and time of recording and the video source of the video being recorded. The system includes probe/detector devices which obtain signals related to the frequency to which the TV, VCR, and cable converter are tuned, and a higher level processor which receives and processes those signals to identify channel tuning of the TV, VCR, and cable converter. The probe/detector monitoring the VCR includes a lower level processor and circuitry that fingerprint a video signal being recorded by the VCR. The system generates timing signals to record and detect fingerprints in the vertical blanking interval of the TV signal. The

system has multilevel processing, and may be programmed to include a number of downloadable and uploading parameters. The system also includes an alphanumeric display and data entry unit for each TV being monitored, and provides for interactive information entry by TV viewers including guests and by an installer.

U.S. Patent No. 5,481,294 teaches an audience measurement system that collects data representative of tuned programs rather than of tuned channels, and includes (i) a household metering apparatus which records ancillary codes or extracts program signatures from the programs if no ancillary codes are found therein, (ii) a reference apparatus which monitors broadcast programs to be monitored, which extracts reference signatures therefrom, which records whatever ancillary codes may be associated with these broadcast programs and, if no ancillary codes are present, which compresses and stores digital replicas representative of the broadcast programs to be monitored, (iii) a data collection apparatus which compares the household and reference data to determine (a) which of the broadcast programs to be monitored were selected for viewing and/or listening, (b) which of the metered households selected the broadcast programs to be monitored for viewing and/or listening, and (c) at which times the broadcast programs to be monitored were selected for viewing and/or listening.

U.S. Patent No. 5,974,299 describes an audience rating system for digital television and radio, using identification codes in control streams of time-multiplexed digital transmissions. When a television set or radio, that is being monitored pursuant to the system, is turned on and tuned into a channel, and each time that the channel is changed, an identification code for each audio, video or auxiliary digital stream of the channel tuned to is extracted from the control stream, and recorded along with the time. The time is also recorded when the television set or radio is turned off. This data makes it possible to determine what stations, channels, and programs members of the audience being monitored

are watching or listening to at any particular time. In the first preferred embodiment, the multiplexed digital transmission is received separately by the television set or radio (or an attached IRD) and a meter connected to it. The meter compares digital streams of the channel being received by the television set or radio with digital streams of each of the channels in the multiplexed digital transmission, until it finds a match. In the second preferred embodiment, the meter does not receive the multiplexed digital transmission separately, but has access to elementary streams extracted from the transmission by an IRD, and extracts identification codes for the channels being received from their elementary streams. The elementary stream may be accessed through an auxiliary connector in a digital decoder, through an access control card connector, or through soldering electrical connections to internal points in the IRD.

SUMMARY OF THE INVENTION

A method and system for identification of channels for purposes of measurement of audiences for digital broadcasts is provided. In digitally transmitted television, a digital stream of data is time multiplexed so that video, audio and data (including without limitation program identification data) for several channels can be sent on a single frequency to a decoder or other reception device. When the user in the home selects a channel to view, the decoder begins taking video, audio and data that are assigned to that channel in the multiplexing scheme employed by the system. There may also be general data such as an electronic program guide that is captured irrespective of the channel that is selected. The video and audio are processed for either analog or digital output as appropriate once the decoder validates that the home meets all the requirements set for viewing the channel or program.

In the present invention, the data structure is configured so that not only can the program identification data (also known as "banner" information) for each program be accessed for viewer use, but also the program identification data or a subset of it such as the channel identification data is output to a data communication port (i.e. serial or parallel port) on the decoder or other reception device, through which port this data is then sent to an audience data gathering and measurement device (meter). This structure also allows the broadcaster to define the data rate (the speed of the digital bits being sent in an asynchronous standard data format) to the data communication port.

A transfer of significant program or channel identification data thus takes place with the present invention. The broadcaster transmits to the decoder a unique start byte, an encoded data byte and a unique stop byte. This defines, for example, the channel selected at the home decoder. The broadcaster sends the coded channel ID information periodically in the service instruction stream.

A probe collects the coded channel ID or other data from the data communication port of the decoder, converts the data into a format readable and recordable by a meter, and transmits the data to the meter in each household that is part of the audience measurement sample. The probe sends channel ID information by a system of low frequencies that are measured in the meter and correlated to a channel map in the unit. Future embodiments are anticipated to transmit the data from the probe to the meter digitally so that interpolation is not necessary and so other types of data can be transferred.

In order to determine what programs are broadcast on identified channels at particular times, program identification data is sent to the data communication port of a decoder or other reception device, and from there to a computer which tracks both program lineup and the airing of advertisements, electronically and automatically by channel. The program identification data may include but is not limited to program start and end time, program

name, censor's classification, program genre, and a brief description of the program. This information only needs to be collected at significant locations for determining or validating program lineups and advertisement data.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features of the invention will become more fully apparent when the following detailed description is read in conjunction with the accompanying drawings in which:

FIG. 1 is a block diagram of the broadcaster, decoder, probe and meter of the present invention;

FIG. 2 is a detailed block diagram of the decoder and probe of the present invention;

FIG. 3 is a flow chart of the functioning of the decoder of the present invention;

FIG. 4 is an electrical schematic of the probe of the present invention;

FIG. 5 is another electrical schematic of the probe of the present invention;

FIG. 6 is a flowchart of the functioning of the probe of the present invention; and

FIG. 7 is another flowchart of the functioning of the probe of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Overview

Referring to FIGS. 1 and 2, in digitally transmitted television, a digital stream of data is time multiplexed so that video, audio and data for several channels can be sent on a single frequency from broadcaster 102. When the user in the home selects a channel to view, the

decoder 104 begins taking video, audio and data that are assigned to that channel in the multiplexing scheme employed by the system. There may also be general delivery data, which is captured irrespective of the channel that is selected. The video and audio are processed for either analog or digital output depending on the system once the decoder validates that the home meets all the requirements set for viewing this program.

The present invention takes advantage of the ability and flexibility of a satellite delivery system where each of the decoders 104 is fitted with a serial port connection. The data structure to the decoder 104 is defined such that some data, such as program identification data and electronic program guide (EPG) information can be sent, and stored for use by the viewer to enhance his ability to make program viewing decisions. Other data may be available for reading of news or other text. The data structure of the present invention is such that program identification data and coded channel ID data is output to the serial port 202 of decoder 104, through which port this data is accessed by the probe 106. The signal is then converted by probe 106 into a meter readable format. The signal is then sent to an audience data gathering and measurement device (meter) 108. This structure also allows for the broadcaster 102 to define the data rate (the speed of the digital bits being sent in an asynchronous standard data format) to the serial port 202. More specifically, the decoder 104 is equipped with operational software in flash memory or other re-writeable but non-volatile memory able to be controlled by the service instruction data packets sent by the broadcaster 102 as digital data to permit portions of the broadcast signal to be directed to various ports of the decoder 104. These service instruction data packets from the broadcaster are used generally to control the functionality of the decoder. One of these service instruction data packets can instruct the decoder to output a data packet, containing the coded channel ID data, to the RS232 port 202 thus enabling the audience data gathering and measurement device (meter) 108 to access the data. To achieve the above function, the

broadcaster 102 adds to the broadcast signal the above service instruction data packets required to direct the coded channel ID data information to the RS232 port 202, from which a probe 106 passes this coded current channel ID data to the meter 108.

Because of the flexibility that exists in the system of the present invention, there is a pathway open whereby a transfer of significant TV audience data can take place as coded channel ID data. The broadcaster 102 transmits to the decoder 104 a unique start byte, an encoded data byte and a unique stop byte. This defines the channel selected at the home decoder. Program identification data, which is similar to the banner and information available to the viewer, may also be sent to the serial RS232 port 202 to enable a computer attached to a decoder 104 to track program lineup and advertisement airing, electronically and automatically per channel. The program banner includes but is not limited to:

Program start and end time
Program name
Censor's classification
Program genre and a brief description of the program

This banner information only needs to be collected at significant locations for validation of program lineups and advertiser data. The broadcaster 102 sends the coded channel ID information periodically (currently every 1-10 seconds) in the service instruction stream.

The probe 106 collects the data from the RS232 serial port 202 of the decoder 104, converts the data into a format readable and recordable by an audience data gathering and measurement device (meter) 108, and transmits to the meter 108 in households that are part of the measurement sample. The probe 106 sends channel information by a system of low frequencies that are measured in the meter 108 and correlated to a channel map in the unit.

Because the decoder 104 has its own programming to which it must respond, filtering of the coded channel ID data takes place at the decoder level. The coded channel ID data is not passed on to the serial RS232 port 202 if any of these conditions exist:

1. The channel selected is not part of the service to which the home has subscribed;
2. Service to the home has been discontinued because of non-payment, or service has never been set up;
3. A parental personal identification number (PIN) has been entered and the program or channel is presently locked out to home viewing;
4. The decoder 104 is in an "off" or standby condition;
5. The channel is pay-per-view, and those pay-per-view conditions have not been met.

If any of the above conditions exist, there would normally be a "blue screen" shown to the viewer and a box describing the reason why the program cannot be viewed in the home. When this condition exists, no coded channel ID data is sent to the RS232 serial port 202. The probe 106 times into a "lock" condition after 20 seconds of not receiving coded channel ID data from the decoder 104.

There are also program selection modes, which the viewer may use on the decoder 104. One is the Mosaic mode, where many small video screens are viewed at once and the user can select by navigation which program he wishes to view. Another is the electronic program guide (EPG) where information on programs for all channels for many days can be looked at in a day/time – channel, chart format. The method of program selection (Mosaic or EPG) is significant to the broadcaster and so these modes are also reportable by the decoder 104 to the RS232 serial port 202.

System Components

The system of the present invention includes the following components.

The Broadcaster: The broadcaster 102 uses its standard digital broadcast equipment known in the art. The broadcaster 102 sets up each channel to be monitored with a data stream which, when periodically sent to the decoder 104 in the home, directs the decoder 104 to send coded channel ID information to the RS232 port 202 at a specified data rate as discussed in further detail below. The digital broadcast can be, for example, satellite, cable or fiber optic.

The Decoder: Presently there are multiple manufacturers of decoder 104 useable in the present invention; each such decoder 104 is able to carry out the commands from the broadcaster's service instruction stream. All exemplary decoders 104 have RS232 ports and SCART connector 204 for detecting an "on" condition. The decoder 104 also carries out overrides in the home. For the decoder 104 to function in the present invention, the home must be subscribed to the service, a parental lock must not be in place for that channel, and the decoder 104 must be in the powered "on" state, or the coded channel ID is not transferred to the RS232 serial port 202. Manufacturers of decoder 104 known in the art include but are not limited to Pace (Model No. DSR620-GM) and Zenith (Model No. DTH310-4).

The Digital Satellite Probe: The probe 106 uses two micro controllers and is connected to the RS232 port 202 of the decoder 104. One microcontroller is used to monitor the RS232 port 202 of the decoder 104. It is able to automatically adjust to changes in the standard baud rates from 1200 to 19,200 baud. The probe 106 includes software that tests the coded channel ID information data stream for a valid signal in the format [STX] [ID Byte] [ETX]. Once a valid ID Byte is isolated from the data stream, the coded channel ID is passed on to the second processor. If a period of 20 seconds passes during which no valid code is received, the probe 106 generates a "lock" code to indicate that the channel is not subscribed to, that it is blocked by parental pin code, or that the signal is missing, indicating that the decoder 104 is in a standby mode. The second micro controller takes the channel data passed

to it and uses a look-up table to determine a matching frequency defined for that channel to be sent to the audience data gathering and measurement device (meter) 108. This frequency is similar to the prescaled UHF local oscillators normally monitored by the meter 108. The channel range from 21-59 is presently used with channels 60-71 being reserved for future expansion and special functions. Channel 70 presently designates the "lock" condition. Channel 60 designates that the mosaic mode is selected where multiple channels are being viewed at once.

THE AUDIENCE DATA GATHERING AND MEASUREMENT DEVICE (METER): The meter 108 is connected to the probe 106 and ascertains the type of probe 106 by the voltage level presented by the divider voltage at pin 3. It detects that the decoder 104 is "on" by the on/off detector signal, takes the frequency inputs and computes an effective channel.

The meter 108 also has many parameters for audience measurement monitoring that have been entered or downloaded for taking samples and reporting information. The meter 108 determines the actual channel being viewed on the television, or being recorded onto a VCR, and adds the viewers in the home who have logged in as watching the program. An exemplary meter 108 is the ACN 6000 unit used by subsidiaries of ACNielsen Corporation.

Decoder Function

Referring to FIGS. 1 and 3, the decoder 104 is equipped with operation software in re-writeable, non-volatile memory able to be controlled by service instruction data packets sent by the broadcaster 102 as digital data such that portions of the broadcast signal is directed to specific ports of decoder 104, best shown in FIG. 3. At block 302 decoder 104 receives the digital transmission, including digital video, audio, electronic program guide and service instruction data packets from broadcaster 102. At block 304, the decoder 104 separates the data received from broadcaster 102 into their video, audio, electronic program

guide and service instruction components. At block 306, the decoder 104 checks the electronic program guide data for booked (pre-selected) channel and service instruction commands. The front panel control can be employed to issue commands at block 308. Any service instruction data from the broadcaster 102, the electronic program guide, or the front panel is processed by decoder 104 at block 310. From block 310, the correct audio and video data for the selected channel is directed by decoder 104 to the audio and video outputs of decoder 104 at block 314. Also from block 310, if the decoder 104 has received from broadcaster 102 service instruction data packets instructing decoder 104 to output a data packet containing the coded channel ID data and/or the program identification data to the RS232 port of decoder 104, the decoder 104 does so. The data from the decoder 104 is received by probe 106 and is converted to an output emulating the appropriate frequency detection system at block 316. At block 318 the converted data from probe 106 is processed by the meter 108.

Probe Components

The probe 106 includes the following hardware components, grouped by functionality.

ID Extraction: Referring to FIGS. 2 and 4, the probe 106 is connected to the decoder 104 by a standard extension 9 pin Dsub connector cable 402. The RS232C port signal from decoder 104 is inputted to Q1 (element 404) which translates the signal to TTL levels for the processor 406 at P3.0. R1 (element 408) limits the current into the base and into the reverse voltage limiting diode D01 (element 410). R02 (element 411) is the pull-up resistor to Vcc. The processors 406 and 412 are given a proper power on reset time by the combination C07 (element 414) and R09 (element 416). The crystal frequency of 11.0592MHz for the processors was chosen to allow the greatest number of baud rate options. The micro controller processors 406 and 412 are both Amtel 89C2051, which are flash based allowing

reuse of the IC if a software upgrade is required. The software automatically adjusts to changes in the Baud Rate of the coded channel ID information data stream and can operate on data rates of 1200, 2400, 4800, 9600, and 19200 baud.

The coded channel ID information data stream from the decoder 104 consists of a start transmit byte [STX], the coded channel ID byte [IDByte] and an end transmit byte [ETX]. The data byte has been structured to make the start and end transmit bytes unique, that is never found in the ID byte, to eliminate false queuing.

Channel Generator: Referring to FIGS. 2 and 4, channel generator 208 operates as follows: Once a coded channel ID has been accepted by processor IC01 (element 406), it is decoded and passed onto second processor IC02 (element 412), through port 1 of both processors. Pull-up resistors RP01 (element 418) are added at this port for noise immunity. Processor IC02 (element 412) takes the coded channel ID, strips out the coding, and does a table look up for the frequency to be sent to the meter 108. The processor 412 outputs this frequency and continues to monitor the input port.

Detector ID: Referring to FIGS. 2 and 4, detector ID 210 functions as follows. The resistor divider R03 (element 420) and R04 (element 422) create a voltage for the meter 108 called the recognition voltage for deciding which probe 106 is plugged into the port to control which software routines to execute for setup and run. The probe 106 is set to duplicate the values of the UNI-Detector 495A and is seen by the meter 108 as a UNI-Det3/4.

The power supply: Referring to FIGS. 2 and 5, power supply 212 includes an external wall transformer with a primary voltage to suit the country of implementation, a secondary voltage of 9 to 15 VDC, and a current capacity greater than 50ma. The connector is a standard DC power jack. The input to the probe 106 is polarity protected by D02 (element 502) and filtered by C02 (element 504) and C03 (element 506). A standard fixed 5 volt regulator is used REG01 (element 508) with a standard high output voltage protection

diode D03 (element 510) and filtering and stabilizing capacitors C04 (element 512) and C01 (element 514). The regulator is well oversized as the nominal current draw is only about 50ma.

The On/Off state detection: Referring to FIGS. 2 and 5, the on/off state detection circuit 214 connects to pin 8 of the scart connector 204 labeled "TV." This pin has a voltage present when the unit is powered. The VCR Scart connector does not have this signal. This signal enters the probe 106 through an RCA connector. When the decoder 104 is on, a voltage greater than 5 VDC is present, the optocoupler OPT01 (element 516) is reverse biased and does not conduct current. When the decoder is "off", the output is either driven low, or becomes a high impedance. The resistor R06 (element 518) limits the current through the isolator, and R07 (element 520) provides a secondary current path for the "decoder off" state current. The optocoupler 516 is "on" when the decoder 104 is in the "off" state. The transistor output pulls down the pull-up resistor R08 (element 522) and presents a low, "off", signal to the meter 108. When the decoder 104 is "on", the optocoupler 516 is "off" and the pull-up resistor R08 (element 522) presents a high or "on" signal to the meter 108.

Probe Function

Probe 106 functions as follows, as best shown in FIGS. 6 and 7. As the probe 106 powers up at block 602, the first processor IC01 (element 406) clears registers, set up timers, counters, and default baud rate selections for the serial communication at block 604. At power up the selected channel is not known, and a "lock" condition is reported at block 604. A "lock" condition is a timed default condition at blocks 604, 606, 608, 610, and 612, which show that after 20 seconds of not receiving data, that a "lock" condition is outputted. This indicates that the decoder 104 is not tuned to something it is allowed to decode and output video, for reasons of either subscription or parental lockout, or that the decoder is not "on". (Because of these and other system configurations with other video sources, the meter 108

must take the coded channel ID along with the on/off detector state and other input states into the meter 108 and ascertain what is being viewed.) After receiving data at block 614, the probe 106 program software looks for a start byte (STX) at block 622. If the byte is a good start byte, a "start" flag is set at block 624 and the software returns to look for the next byte of data. As the next byte of data is received, the software ascertains that the "started" flag is set at blocks 614, 616, and 618, and takes that byte of data for the coded channel ID and saves it to a register called Tempdata, for use when a valid end of transmission byte is received, thus validating the string. When the next byte of data is received, and it is ascertained that data has been taken by the "ID taken" flag set at block 618, then the data is tested to see if it is an end of transmission byte (ETX) at block 620. If the received byte is validated, the coded channel ID stored in Tempdata is outputted to processor IC02 (element 412) at block 626, and the reception flags are cleared, the "lock" timer is reset, and the Bytecount is reset at block 628. If a received byte is not validated in block 620 or block 622, the Bytecount register is incremented at block 630, and any reception flags that have been set are cleared. The Bytecount register is then checked to see if it has passed a number set to indicate that a baud rate miss-match must have occurred at block 632. When this number is passed, a baud rate adjustment routine is entered where the correct baud rate is selected on the next transmission, at block 634.

Referring next to FIG. 7, after the coded channel ID stored in temp data is outputted to processor IC02 (element 412) at block 626 of FIG. 6, probe 106 starts, at block 702, a meter frequency matching program. From block 702 the variables and frequency look-up tables are initialized at block 704. The coded channel ID input is read at block 706, and the coded channel ID is sent to the meter 108 at block 708 at the frequency determined at block 704.

CLAIMS

We claim:

1. An apparatus for measuring the audience for a digital television or radio program comprising:

a digital decoder attachable to a digital television or radio, said digital decoder adapted to receive digital data from a broadcast source, said digital data including a service instruction stream having program information therein for each of a plurality of viewable channels, said program information being accessible to a viewer, said digital decoder including a channel selector actuatable by a viewer to select a channel to be viewed, said digital decoder including a digital data output port;

means for separating said program information of the channel being viewed from said digital data from said broadcast source; and

means for recording said separated program information of the channel being viewed to measure the audience for such program.

2. The apparatus of claim 1 wherein said means for separating said program information of the channel being viewed includes a command transmitted by said broadcast source to said digital decoder, said command instructing said digital decoder to separate said program information, and further including means for responding to said command located in said digital decoder to effectuate separation of said program information of the channel being viewed from said digital data.

3. The apparatus of claim 1 wherein said separated program information of the channel being viewed passes through said digital data output port prior to being accessed by said means for recording said separated program information.

4. The apparatus of claim 1 further comprising:

means for decoding said separated program information connectable between said digital decoder and said means for recording said separated program information, said means for decoding said separated program information being adapted to convert said separated program information into a data format usable by said means for recording said separated program information.

5. The apparatus of claim 4 wherein said means for decoding said separated program information is connectable to said digital data output port of said digital decoder.

6. An apparatus for measuring the audience for a digital television or radio program comprising:

a digital decoder attachable to a digital television or radio, said digital decoder adapted to receive digital data from a broadcast source, said digital data including a service instruction stream having program information therein for each of a plurality of viewable channels, said program information being accessible to a viewer, said digital decoder including a channel selector actuatable by a viewer to select a channel to be viewed, said digital decoder including a digital data output port;

means for separating said program information of the channel being viewed from said digital data from said broadcast source;

means for recording said separated program information of the channel being viewed to measure the audience for such program; and

means for decoding said separated program information connectable between said digital decoder and said means for recording said separated program information, said means for decoding said separated program information being adapted to convert said separated program information into a data format usable by said means for recording said separated program information.

7. The apparatus of claim 6 wherein said means for decoding said separated program information is connectable to said digital data output port of said digital decoder.

8. The apparatus of claim 6 wherein said means for separating said program information of the channel being viewed includes a command transmitted by said broadcast source to said digital decoder, said command instructing said digital decoder to separate said program information, and further including means for responding to said command located in said digital decoder to effectuate separation of said program information of the channel being viewed from said digital data.

9. The apparatus of claim 6 wherein said separated program information of the channel being viewed passes through said digital data output port prior to being accessed by said means for recording said separated program information.

10. An apparatus for measuring the audience for a digital television or radio program comprising:

a digital decoder attachable to a digital television or radio, said digital decoder adapted to receive digital data from a broadcast source, said digital data including a service identification data stream having program information therein for each of a plurality of viewable channels, said program information being accessible to a viewer, said digital decoder including a channel selector actuatable by a viewer to select a channel to be viewed, said digital decoder including a digital data output port;

means for separating said program information of the channel being viewed from said digital data from said broadcast source; and

means for recording said separated program information of the channel being viewed to measure the audience for such program, wherein said means for separating said program information of the channel being viewed includes a command transmitted by said broadcast source to said digital decoder, said command instructing said digital decoder to separate said program information, and further including means for responding to said command located in said digital decoder to effectuate separation of said program information of the channel being viewed from said digital data.

11. The apparatus of claim 1 wherein said separated program information of the channel being viewed passes through said digital data output port prior to being accessed by said means for recording said separated program information.

12. The apparatus of claim 10 further comprising:

means for decoding said separated program information connectable between said digital decoder and said means for recording said separated program information, said means for decoding said separated program information being adapted to convert said separated

program information into a data format usable by said means for recording said separated program information.

13. The apparatus of claim 12 wherein said means for decoding said separated program information is connectable to said digital data output port of said digital decoder.

14. A system for measuring the audience for a digital television or radio program comprising:

using a digital decoder attachable to a digital television or radio to receive digital data from a broadcast source, said digital data including a service instruction stream having program information therein for each of a plurality of viewable channels, said program information being accessible to a viewer, said digital decoder including a channel selector actuatable by a viewer to select a channel to be viewed, said digital decoder including a digital data output port;

separating said program information of the channel being viewed from said digital data from said broadcast source; and

recording said separated program information of the channel being viewed to measure the audience for such program.

15. The system of claim 14 wherein separating said program information of the channel being viewed includes transmitting a command by said broadcast source to said digital decoder, said command instructing said digital decoder to separate said program information, and further including responding to said command by said digital decoder to

effectuate separation of said program information of the channel being viewed from said digital data.

16. The system of claim 14 further comprising:

decoding said separated program information prior to recording said separated program information, decoding said separated program information including converting said separated program information into a data format usable by means for recording said separated program information.

17. A system for measuring the audience for a digital television or radio program comprising:

using a digital decoder attachable to a digital television or radio to receive digital data from a broadcast source, said digital data including a service instruction stream having program information therein for each of a plurality of viewable channels, said program information being accessible to a viewer, said digital decoder including a channel selector actuatable by a viewer to select a channel to be viewed, said digital decoder including a digital data output port;

separating said program information of the channel being viewed from said digital data from said broadcast source; and

recording said separated program information of the channel being viewed to measure the audience for such program wherein said means for separating said program information of the channel being viewed includes a command transmitted by said broadcast source to said digital decoder, said command instructing said digital decoder to separate said program information, and further including means for responding to said command located in said

digital decoder to effectuate separation of said program information of the channel being viewed from said digital data.

18. The system of claim 17 further comprising:

decoding said separated program information prior to recording said separated program information, decoding said separated program information including converting said separated program information into a data format usable by means for recording said separated program information.

19. A system for measuring the audience for a digital television or radio program comprising:

using a digital decoder attachable to a digital television or radio to receive digital data from a broadcast source, said digital data including a service instruction stream having program information therein for each of a plurality of viewable channels, said program information being accessible to a viewer, said digital decoder including a channel selector actuatable by a viewer to select a channel to be viewed, said digital decoder including a digital data output port;

separating said program information of the channel being viewed from said digital data from said broadcast source;

recording said separated program information of the channel being viewed to measure the audience for such program; and

decoding said separated program information prior to recording said separated program information, decoding said separated program information including converting said

separated program information into a data format usable by means for recording said separated program information.

20. The system of claim 19 wherein separating said program information of the channel being viewed includes transmitting a command by said broadcast source to said digital decoder, said command instructing said digital decoder to separate said program information, and further including responding to said command by said digital decoder to effectuate separation of said program information of the channel being viewed from said digital data.

21. An apparatus for measuring the audience for a digital television or radio program comprising:

a digital decoder attachable to a digital television or radio, said digital decoder adapted to receive digital data from a broadcast source, said digital data including a service instruction stream having program information and having a start byte, encoded data byte and stop byte therein for each of a plurality of viewable channels, said program information being accessible to a viewer, said digital decoder including a channel selector actuatable by a viewer to select a channel to be viewed, said digital decoder including a digital data output port;

means for separating said program information of the channel being viewed from said digital data from said broadcast source by accessing said start byte, said encoded data byte and said stop byte; and

means for recording said separated program information of the channel being viewed to measure the audience for such program.

22. The apparatus of claim 21 wherein said means for separating said program information of the channel being viewed includes a command transmitted by said broadcast source to said digital decoder, said command instructing said digital decoder to separate said program information, and further including means for responding to said command located in said digital decoder to effectuate separation of said program information of the channel being viewed from said digital data.

23. The apparatus of claim 21 wherein said separated program information of the channel being viewed passes through said digital data output port prior to being accessed by said means for recording said separated program information.

24. The apparatus of claim 21 further comprising:

means for decoding said separated program information connectable between said digital decoder and said means for recording said separated program information, said means for decoding said separated program information being adapted to convert said separated program information into a data format usable by said means for recording said separated program information.

25. The apparatus of claim 24 wherein said means for decoding said separated program information is connectable to said digital data output port of said digital decoder.

26. A system for measuring the audience for a digital television or radio program comprising:

using a digital decoder attachable to a digital television or radio to receive digital data from a broadcast source, said digital data including a service instruction stream having program information and having a start byte, encoded data byte and stop byte therein for each of a plurality of viewable channels, said program information being accessible to a viewer, said digital decoder including a channel selector actuatable by a viewer to select a channel to be viewed, said digital decoder including a digital data output port;

separating said program information of the channel being viewed from said digital data from said broadcast source by accessing said start byte, said encoded data byte and said stop byte; and

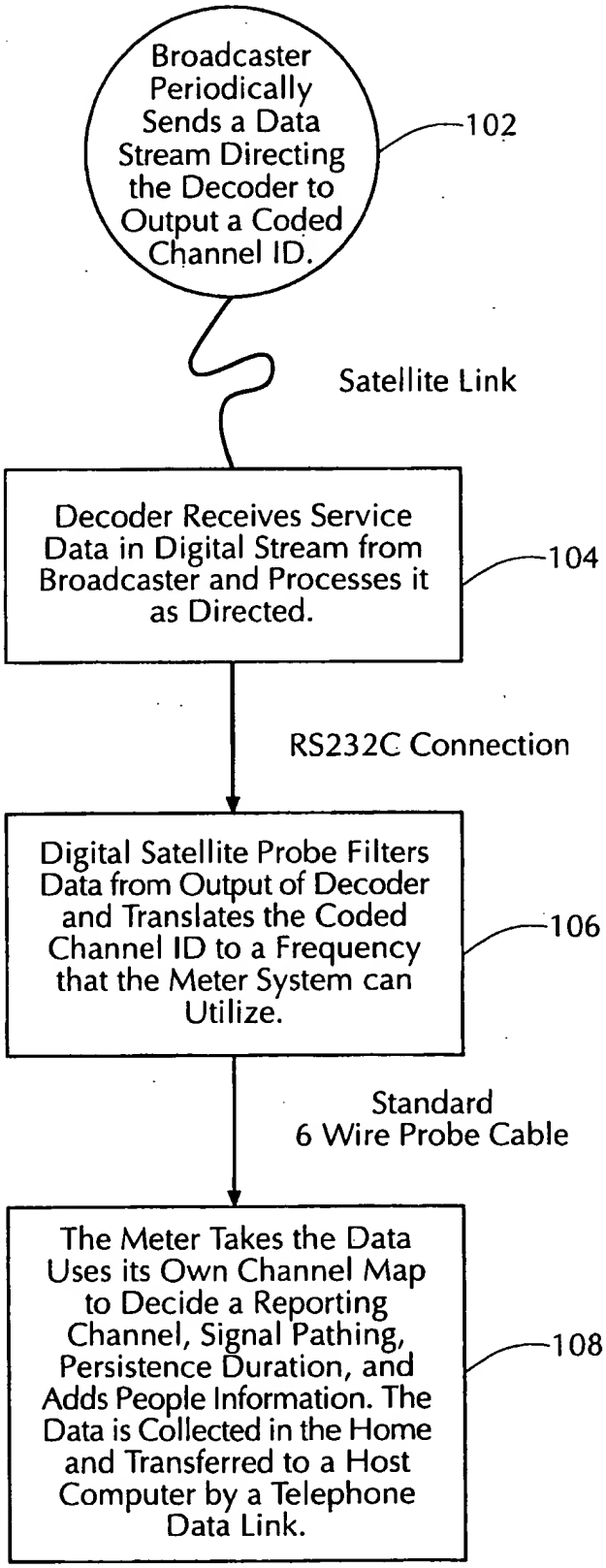
recording said separated program information of the channel being viewed to measure the audience for such program.

27. The system of claim 26 wherein separating said program information of the channel being viewed includes transmitting a command by said broadcast source to said digital decoder, said command instructing said digital decoder to separate said program information, and further including responding to said command by said digital decoder to effectuate separation of said program information of the channel being viewed from said digital data.

28. The system of claim 26 further comprising:

decoding said separated program information prior to recording said separated program information, decoding said separated program information including converting said separated program information into a data format usable by means for recording said separated program information.

FIG. 1


Broadcaster Periodically Sends a Data Stream Directing the Decoder to Output a Coded Channel ID.
102
Satellite Link
Decoder Receives Service Data in Digital Stream from Broadcaster and Processes it as Directed.
104
RS232C Connection
Digital Satellite Probe Filters Data from Output of Decoder and Translates the Coded Channel ID to a Frequency that the Meter System can Utilize.
106
Standard 6 Wire Probe Cable
The Meter Takes the Data Uses its Own Channel Map to Decide a Reporting Channel, Signal Pathing, Persistence Duration, and Adds People Information. The Data is Collected in the Home and Transferred to a Host Computer by a Telephone Data Link.
108

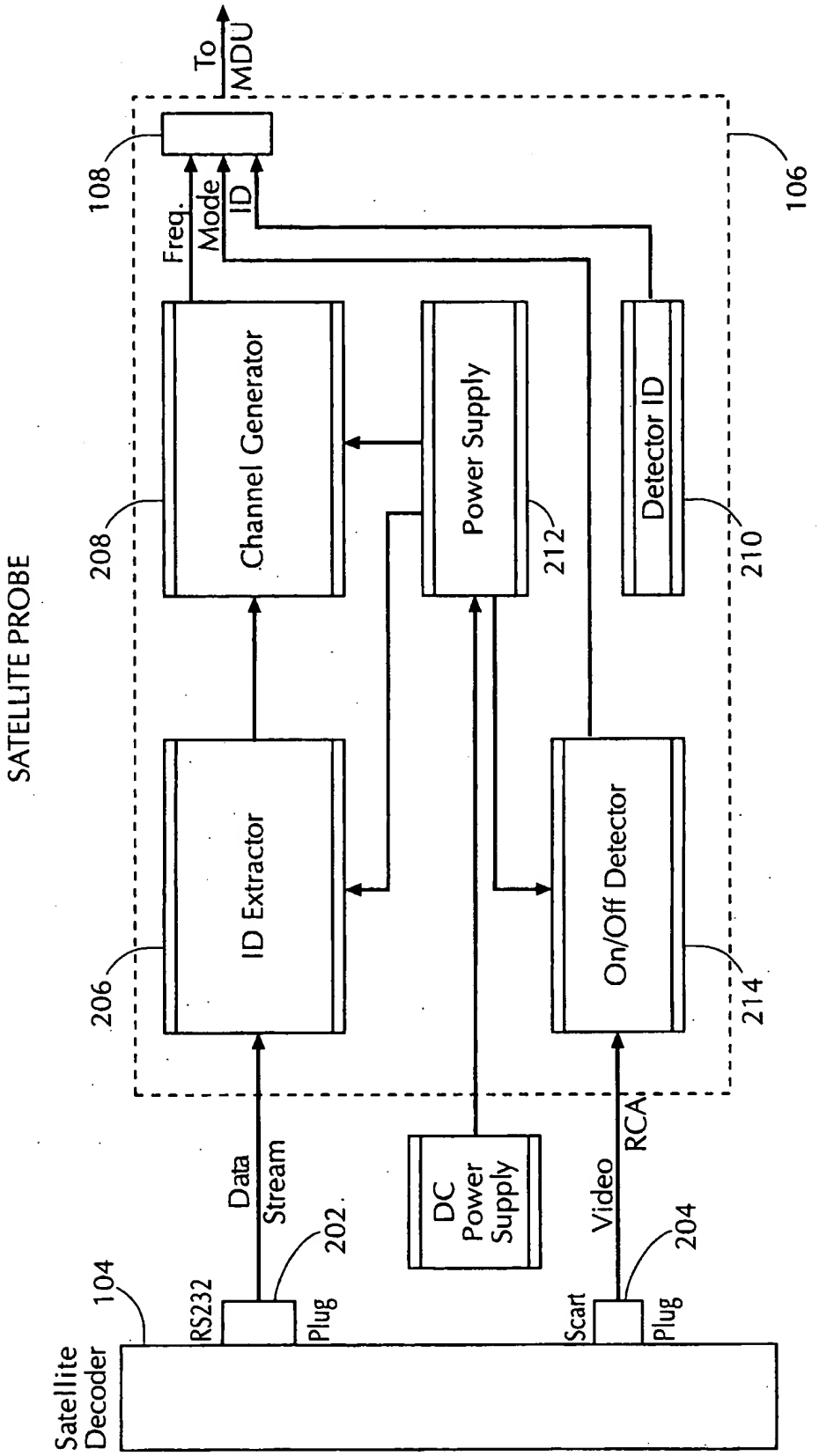
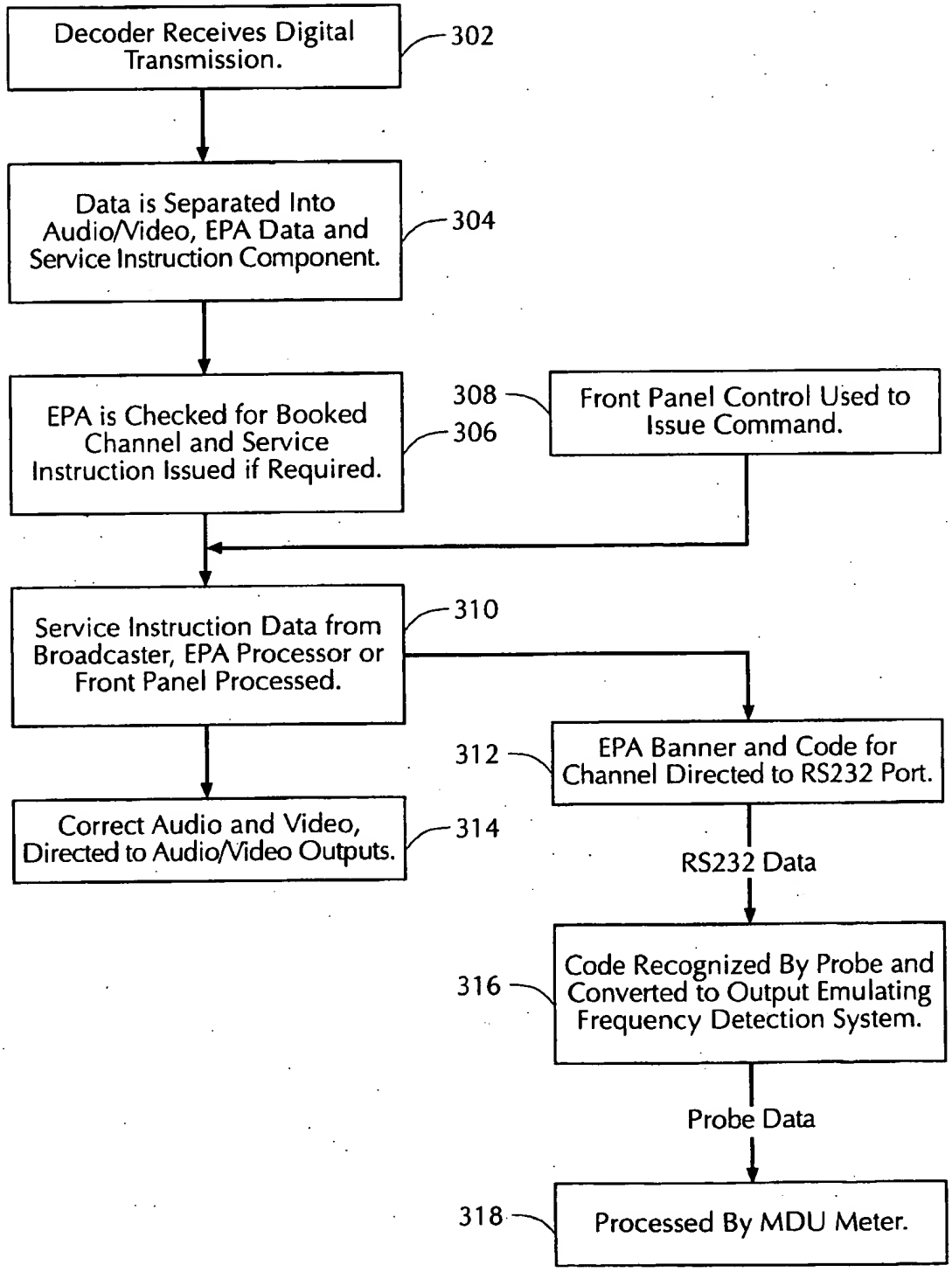

To MDU
108
106
Freq.
Mode
ID
SATELLITE PROBE
Channel Generator
208
Power Supply
212
Detector ID
210
ID Extractor
206
On/Off Detector
214
Data Stream
202
DC Power Supply
Video
RCA
204
104
RS232
Plug
Scart
Plug
Satellite Decoder

FIG. 2

FIG. 3


Decoder Receives Digital Transmission.
302
Data is Separated Into Audio/Video, EPA Data and Service Instruction Component.
304
EPA is Checked for Booked Channel and Service Instruction Issued if Required.
306
308
Front Panel Control Used to Issue Command.
Service Instruction Data from Broadcaster, EPA Processor or Front Panel Processed.
310
312
EPA Banner and Code for Channel Directed to RS232 Port.
Correct Audio and Video, Directed to Audio/Video Outputs.
314
RS232 Data
316
Code Recognized By Probe and Converted to Output Emulating Frequency Detection System.
Probe Data
318
Processed By MDU Meter.

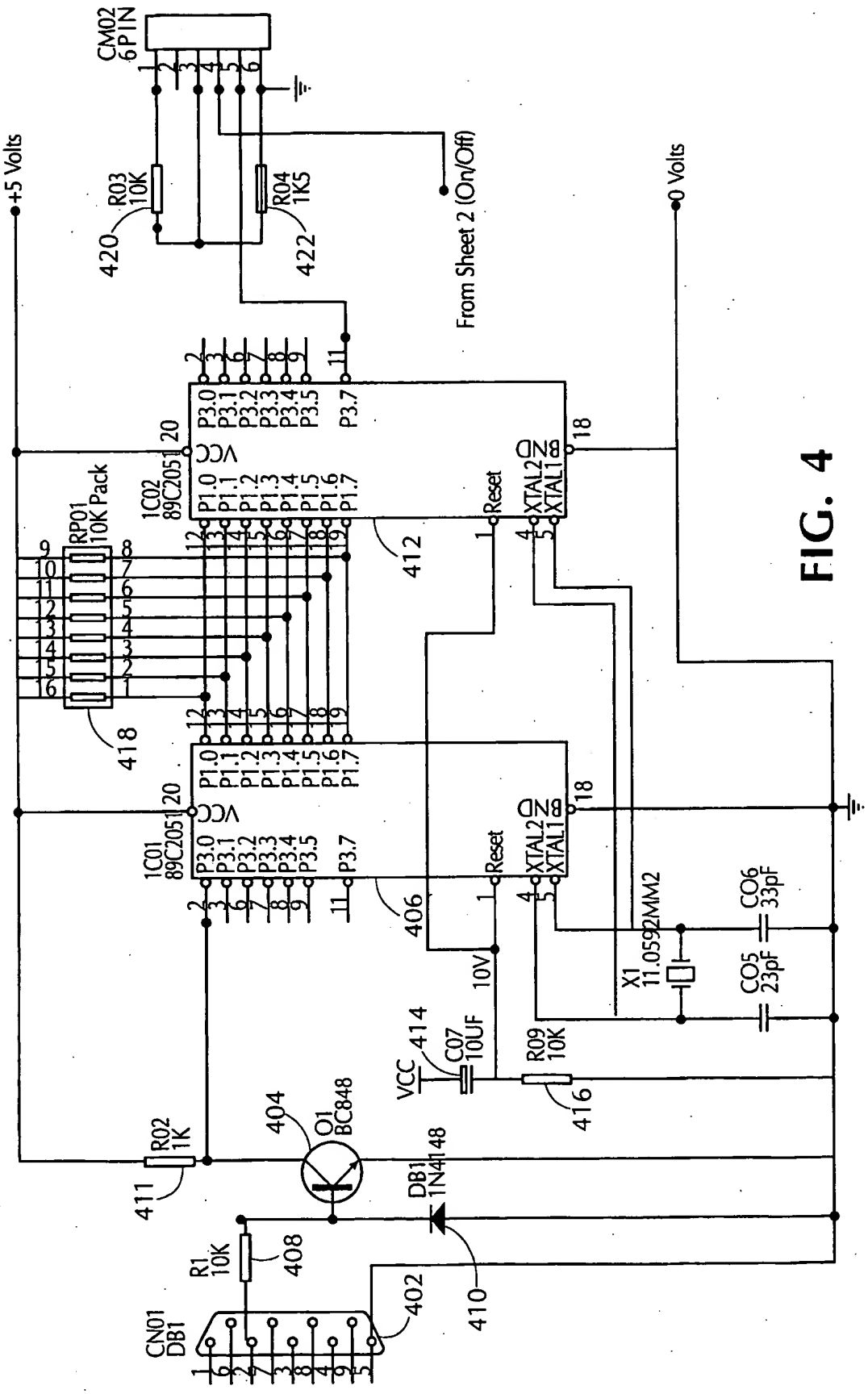

CM02
6PIN
+5 Volts
R03
10K
420
R04
1K5
422
From Sheet 2 (On/Off)
0 Volts
RP01
10K Pack
418
1C02
89C2051
1C01
89C2051
P3.0
P3.1
P3.2
P3.3
P3.4
P3.5
P3.7
P1.0
P1.1
P1.2
P1.3
P1.4
P1.5
P1.6
P1.7
VCC
GND
Reset
XTAL2
XTAL1
412
406
X1
11.0592MM2
CO5
23pF
CO6
33pF
10V
C07
10UF
VCC
414
R09
10K
416
404
Q1
BC848
R02
1K
411
DB1
1N4148
R1
10K
408
410
402
CN01
DB1

FIG. 4

FIG. 5

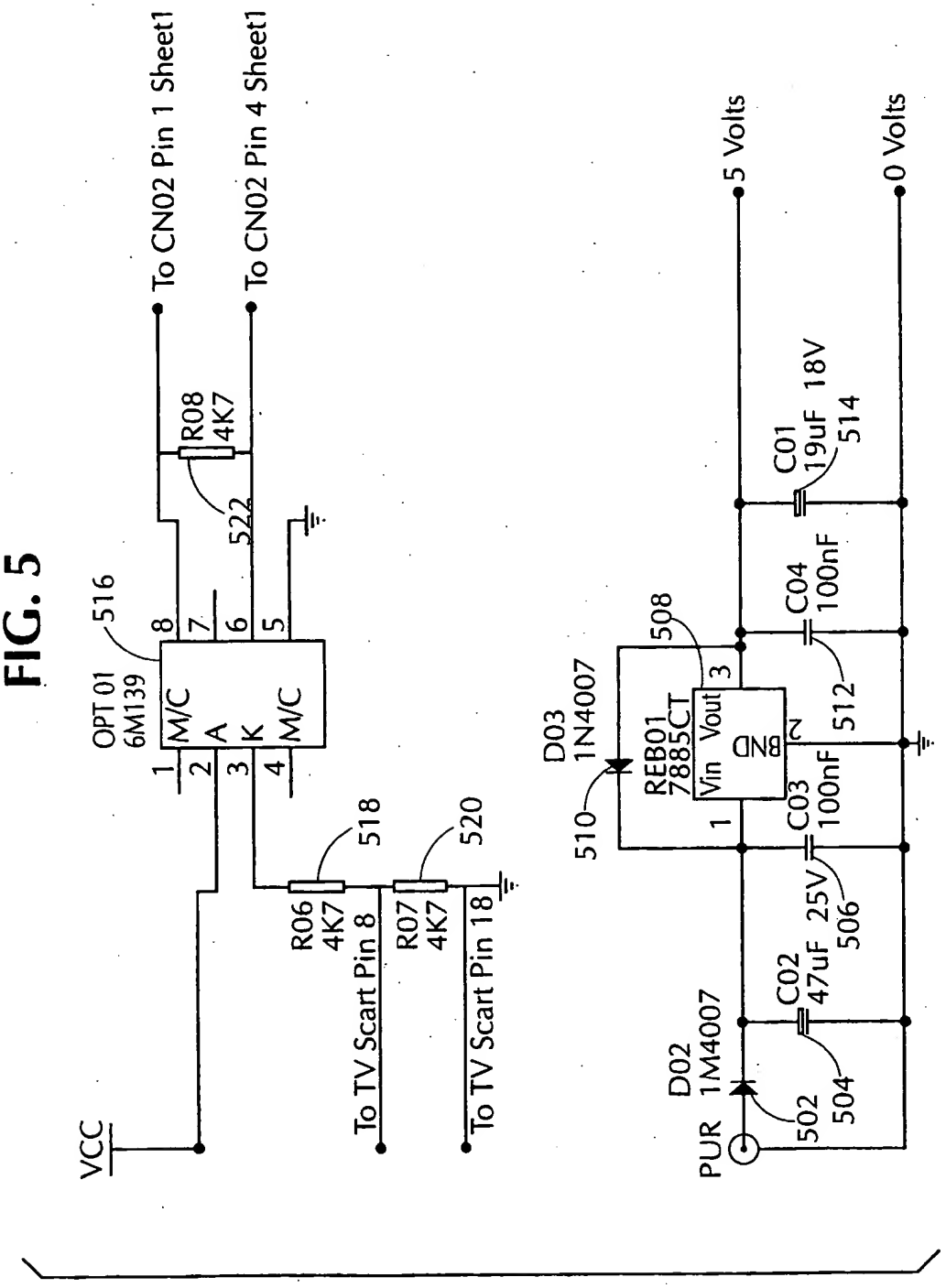

To CN02 Pin 1 Sheet1
To CN02 Pin 4 Sheet1
R08 4K7
522
OPT 01 6M139
516
M/C
A
K
M/C
1
2
3
4
5
6
7
8
R06 4K7
518
R07 4K7
520
To TV Scart Pin 8
To TV Scart Pin 18
VCC
D03 1N4007
510
508
REB01 7885CT
Vin
Vout
GND
C04 100nF
512
C03 100nF
C01 19uF 18V
514
C02 47uF 25V
506
D02 1M4007
PUR
502
504
5 Volts
0 Volts

FIG. 6

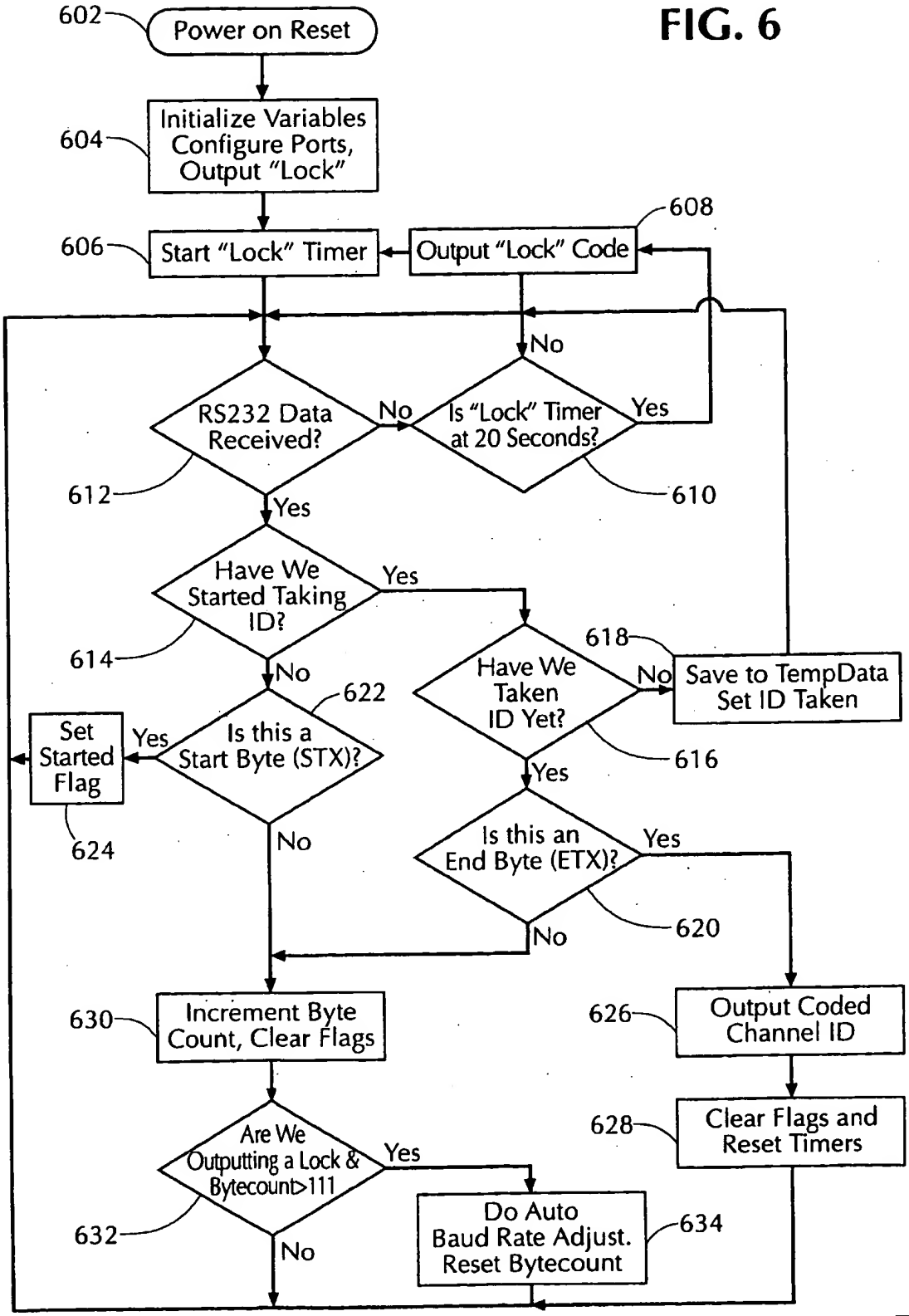
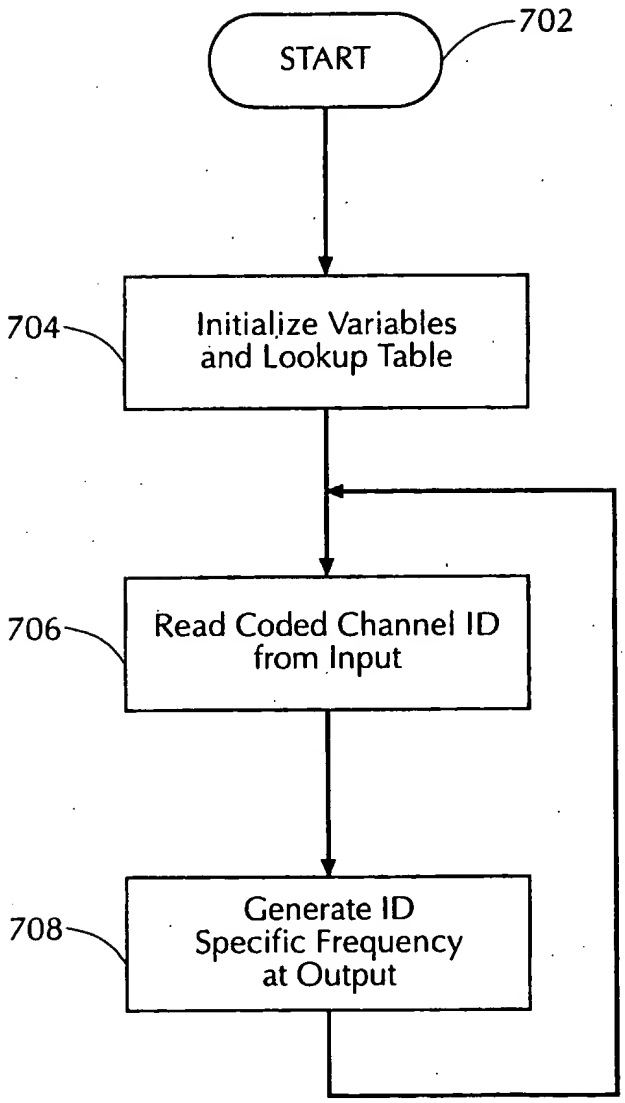

602
Power on Reset
604
Initialize Variables Configure Ports, Output "Lock"
606
Start "Lock" Timer
608
Output "Lock" Code
No
RS232 Data Received?
No
Is "Lock" Timer at 20 Seconds?
Yes
612
610
Yes
Have We Started Taking ID?
Yes
614
618
Have We Taken ID Yet?
No
Save to TempData Set ID Taken
No
622
Set Started Flag
Yes
Is this a Start Byte (STX)?
616
Yes
624
No
Is this an End Byte (ETX)?
Yes
620
No
630
Increment Byte Count, Clear Flags
626
Output Coded Channel ID
628
Clear Flags and Reset Timers
Are We Outputting a Lock & Bytecount>111
Yes
632
No
Do Auto Baud Rate Adjust. Reset Bytecount
634

FIG. 7


START
702
Initialize Variables and Lookup Table
704
Read Coded Channel ID from Input
706
Generate ID Specific Frequency at Output
708